From trickle to torrent . . . a rousing introduction to waterway geology . . .

Rivers: The Work of Running Water

A 16mm sound film or videocassette—22 minutes

This lively exploration of how rivers "work" focuses on the Colorado and Mississippi Rivers. Viewers see and are able to understand how rivers move soil, sand, and even huge boulders . . . how they shape and reshape land . . . their importance in irrigation . . . the benefits and problems of dams . . . and the differences between two of America's greatest river systems. An informative film, equally fascinating for educational and general viewing.

Encyclopaedia Britannica Educational Corporation

Rivers: The Work of Running Water

- Shows the progressive stages in the development of streams and rivers along their paths from highland areas to the sea.
- Looks at the special ways that water erodes and carries its load of sediments.
- Shows types of erosional landforms and depositional landforms that were shaped by running water.
- Explores how running water affects human activities and the role running water has played in the development of inhabited regions.

St. Louis—a major port on the Mississippi River.

Content Summary

High in the Rocky Mountains, a trickle of water marks the beginning of the mighty Colorado River. The river flows across Utah into Lake Powell; through the Grand Canyon to Lake Mead on the Arizona-Nevada border; and finally across California into the Gulf of California in Mexico, where its 1700-kilometer trek ends in the Pacific Ocean.

A close examination of the water reveals sediment that forms the suspended load of the stream. The steep gradient causes the water to flow faster. As stream velocity increases, the water picks up rock particles that polish the rocks over which the stream passes. Where the gradient is less steep, the velocity of the stream slows. Because the stream gradient constantly changes, so does the stream's velocity. And when the current of the river is strong, the turbulent flow enables the water to move anything from pebbles to boulders.

The heavier rocks moved by the river are part of its bed load. Where the gradient is reduced, the river is wider and deeper and the current velocity slows. It is here that the Colorado and its many tributaries gather still more sediment to be transported and eventually deposited at locations downstream. Many small creeks originate in the mountains only to join the Colorado in its journey to the Gulf of California.

Once the Colorado leaves the mountains, it flows into a valley. The river is swollen from rain and muddy from its increased suspended load of sediment. Because of the increased volume and velocity, the river can carry a heavier load during times of flooding. Downstream, we can see canyon walls that are testament to millions of years of erosion caused by the river. But, as the volume and velocity of the river decrease, the products of this erosion are deposited to form landforms such as sandbars.

Sandbars consist of many layers of sediment. Each layer represents a specific interval of deposition. Measurements taken by the United States Geological Survey show the varied current flow and sediment load. Much of the river's load consists of sand, silt, and clay suspended in the water. Larger particles are bounced along the streambed in a process called saltation. Still larger rocks are pushed or dragged along the bottom.

As the Colorado River flows across the state of Utah, we can see evidence of the river's spectacular ability to shape the landscape. On this plateau rocks, carved over millions of years ago, reveal part of the earth's history. The canyons that characterize this plateau have been widened by lateral erosion as rains loosen rock and soil, causing them to move downslope in response to gravity. Excessive runoff water during heavy rains may cause flash floods. During the sheetwash process, water spreads across the land, carrying with it sediment that is deposited into stream-cut gulleys that may join a tributary that will flow into the canyon.

The Green River is a major tributary of the Colorado. Where the two rivers meet, the Green River deposits its sediment load into the Colorado. In addition to the previously described methods of erosion, stream channels also undergo headward erosion. This lengthens the stream and may cause the water of one stream to be captured by another. This is called stream piracy.

Beyond nature's own geological processes, humans also have shaped part of the Colorado River. In southern Utah, part of the river has been dammed to form the 250-kilometer man-made lake, Lake Powell.

Near the southern end of the Grand Canyon, one of Earth's most spectacular natural wonders, lies Lake Mead. This lake, also formed by a dam, has 80,000 tons of sediment dropped on the bottom of its waters each day. By the end of the twenty-first century, scientists say the lake will no longer exist. Because lakes silt up, geologists consider lakes to be a temporary part of the earth's landscape.

Lake Mead forms behind Hoover Dam. This great dam makes it possible to regulate the output of the Colorado River, therefore preventing the flooding of parts of southern California and northwestern Mexico. The dam supplies and generates power for metropolitan areas in Arizona, Nevada, and Southern California. It also supplies enormous quantities of water to the cities of Las Vegas and Los Angeles. Farmers in Arizona have turned drab desert wasteland into rich productive farmland thanks to the water supply controlled by the Hoover Dam. Excess water not used for irrigation or for generating power flows

The Colorado River.

southward into Mexico and the Gulf of California where it ends its long journey.

In contrast to the young, swift-flowing Colorado River, the slow-moving waters of the much older Mississippi River drain an area roughly five times as large. That accounts for almost 41 percent of the surface of the United States. This river flows across the lower part of North America where the surface of the land is nearly level. From its origin just north of St. Louis, Missouri, the river follows a path that ends in the Gulf of Mexico. There is relatively little turbulent flow in the Mississippi because of the flat stream gradient. The flatlands surrounding the river banks are flood plains containing incredibly fertile soils for seasonal crops in this northern climate. The Mississippi is an important route for trade and commerce, especially because of the abundance of crops along the river banks. St. Louis has become a major city because of its prime location on the river.

Because of the high volume of travel on the river, engineers study sediment loads to determine where navigational hazards might occur. In some places, the river flows over land that is so flat that the river strays from its path. This phenomenon is called a meander. During times of flooding, this entire horizontal surface is covered by water. In the spring, flooding along the Mississippi farmlands is more likely to occur. Because the land is flat, dams are of little use. After flood waters recede, the stream-cut meanders are often wider than they were before. When a looplike meander nears full circle, an oxbow is formed. When the oxbow is cut off, it forms an oxbow lake.

Along the river banks, flood-borne sediments may build natural levees, ridges that may be many meters high. During the flood stage, natural levees may form when a stream flows onto the floodplain. The largest amount of sediment is laid down along the banks of the channel and tends to build up a ridge or natural embankment. Sediment-choked channels must be dredged in order to keep the river open for transportation. New Orleans is the mecca of most transportation along the river. It is here that ocean freighters meet the river barges.

When the river reaches its end, with rapidly decreasing velocity, it drops its sediment load to form a delta. As more sediment is added, the delta grows progressively farther into the sea. As the river approaches the Gulf, the main channel divides into distributaries that form on the delta surface. Between the distributaries lie salt water marshes filled with fine-grained sediment.

Rivers have affected the earth and its inhabitants for billions of years, but the path of a river today may not be its path tomorrow. As geological processes change, so will the earth and its inhabitants.

For Discussion

Before viewing:

1. What accounts for the speed at which a river travels?
2. Why would the velocity of the Colorado River differ from that of the Mississippi River?
3. What is the purpose of a dam?
4. The following terms may need to be discussed before viewing the film or videocassette:

bed load	gradient	reservoir
current velocity	headward erosion	saltation
delta	lateral erosion	sediment
depositional landforms	load	sheetwash
distributaries	meanders	silt
downward erosion	natural levee	stream piracy
drainage basin	oxbow lake	suspended load
erosion	plateau	tributary
floodplain	rain wash	turbulent flow

After viewing:

1. What makes up the suspended load of a stream?
2. What causes a stream's velocity to vary?
3. What is the difference between suspended load and bed load?

Rainstorm over the Grand Canyon.

4. Give examples of erosional landforms and depositional landforms. How do they differ in origin?
5. How is sediment measured in the Colorado River?
6. Define downward, lateral, and headward erosion.
7. In what ways has human activity altered the character of the Colorado River? Rivers in your area?
8. Why may it be said that geologists consider lakes "to be temporary features of the landscape"? Explain.
9. What purposes does Hoover Dam serve?
10. Why is the soil along the banks of the Mississippi River richer than the soil along the Colorado River?
11. Compare and contrast the paths of both rivers and describe their physical differences.
12. Why would there be more trade and commerce along the Mississippi River than along the Colorado River?
13. Describe meanders and explain how they are related to oxbow lakes.
14. Describe the build-up of natural levees along the Mississippi River.
15. Why is it important that channels along the Mississippi be dredged? How is dredging accomplished?
16. What are deltas? How are they formed?
17. Describe the geological, economical, and historical importance of both the Colorado and Mississippi Rivers.
18. Trace the paths of other important rivers in the United States, and compare their importance with that of the Mississippi and Colorado Rivers.

Collaborator

Dr. Robert E. Boyer
Dean of the College of Natural Sciences
University of Texas, Austin

In cooperation with
American Geological Institute
William H. Matthews III
Director of Education

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Length

Rivers: The Work of Running Water, color film no. 3697, is 22 minutes long.

Replacement Footage

To order replacement footage for damaged portions of film, refer to the numbers that appear on the perforated edge. Example of footage order: *Rivers: The Work of Running Water.* Send footage starting with number 0125 through number 0186, a total of 61 feet.

About Videocassettes

Videocassettes are available for all EBE 16mm films in the following formats: ¾" U-Matic; ½" Beta II; ½" VHS—all in NTSC standard.

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Write to:

Encyclopaedia Britannica Educational Corporation
425 North Michigan Avenue
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